ENERGY INFORMATION PAPER

ENERGY TRENDS IN COMMERCIAL AND INSTITUTIONAL BUILDINGS

ENERGY TRENDS IN ONTARIO
A FIVE PART SERIES

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INTRODUCTION

This paper is one of a five-part series that analyzes the recent historical trends in Ontario's energy consumption, and complements the forecast for provincial energy consumption contained in **Energy 2000 – The Shape of Ontario's Energy Demand.**

This paper details the energy use trends that have emerged in commercial and institutional buildings across the province. The other papers in the series highlight the trends in industrial, residential, transportation and total energy use for the province.

ENERGY TRENDS IN COMMERCIAL AND INSTITUTIONAL BUILDINGS

The commercial and institutional segment of Ontario's economy is the part of the economy that provides services, as opposed to hard goods. This segment of the economy is housed in a large number and variety of buildings, ranging from corner convenience stores to enclosed shopping malls, low-rise warehouses to skyscraping office towers, hockey arenas to hospitals and nursing homes. All these buildings need to be heated, lighted and supplied with power to run equipment. The total area of floorspace in commercial and institutional buildings in Ontario is enormous, amounting to some 180-million square metres, or about the same area contained in more than 7,600 Metro Toronto Convention Centres.

Most of these buildings were built before the cost of energy was an important consideration for building owners and operators. As a result, some of the buildings use energy inefficiently, with energy use levels that can be two or three times greater than buildings that incorporate modern, energy-saving technologies and construction methods. As well, a large factor in a building's energy consumption depends on what the building is being used for. A warehouse has vastly different energy needs than a hospital, for example.

Services such as recreation, education, health care, and retail and wholesale trading have been the fastest-growing portion of Ontario's economy over the last 15 years. By 1985, services accounted for more than 60 per cent of Ontario's total economic output, and close to 70 per cent of total employment.

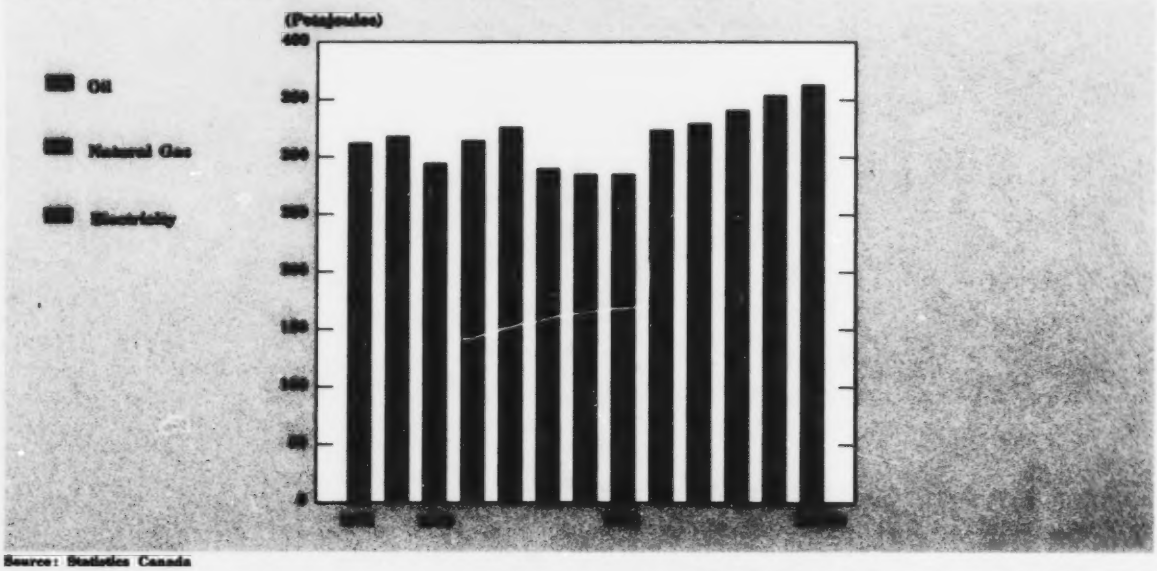
In the early 1970s, increases in output, employment and floorspace caused energy use in commercial and institutional buildings to rise rapidly. In the 1970-73 period, energy use in these operations grew by an average of nearly 5 per cent per year.

However, escalating energy costs after 1973 made energy conservation and fuel substitution investments attractive to many commercial and institutional building owners and operators. More efficient use of energy reduced the growth rate of energy consumption in commercial and institutional operations to 1.2 per cent annually between 1973 and 1985.

During the same period, economic output for the service sector increased by an average of nearly 3 per cent, and employment by almost 4 per cent per year.

In 1973, Ontario used 315 petajoules of refined petroleum products, natural gas and electricity to heat, cool and light commercial and institutional buildings and run auxiliary equipment.* By 1985, total energy use had increased to an estimated 364 petajoules per year. This is equivalent to 9.4 million cubic metres, or, 59 million barrels of light fuel oil and is equal to 15 per cent of the total end-use energy requirements for the entire province.

ENERGY USE IN COMMERCIAL AND INSTITUTIONAL BUILDINGS



Source: Statistics Canada

*A petajoule is a measure of the heat content of fuels. One petajoule is equal to a quadrillion (10^{15}) joules, or the energy contained in 29 million litres of gasoline.

Factors That Determine Commercial And Institutional Energy Use

Most of the energy consumed by commercial and institutional buildings is directly related to the amount of floorspace being utilized. Heating and cooling are the largest energy users, accounting for about two-thirds of the total energy used in 1985. In the same year, lighting required 14 per cent of the energy, while water heating and equipment operation accounted for the rest.

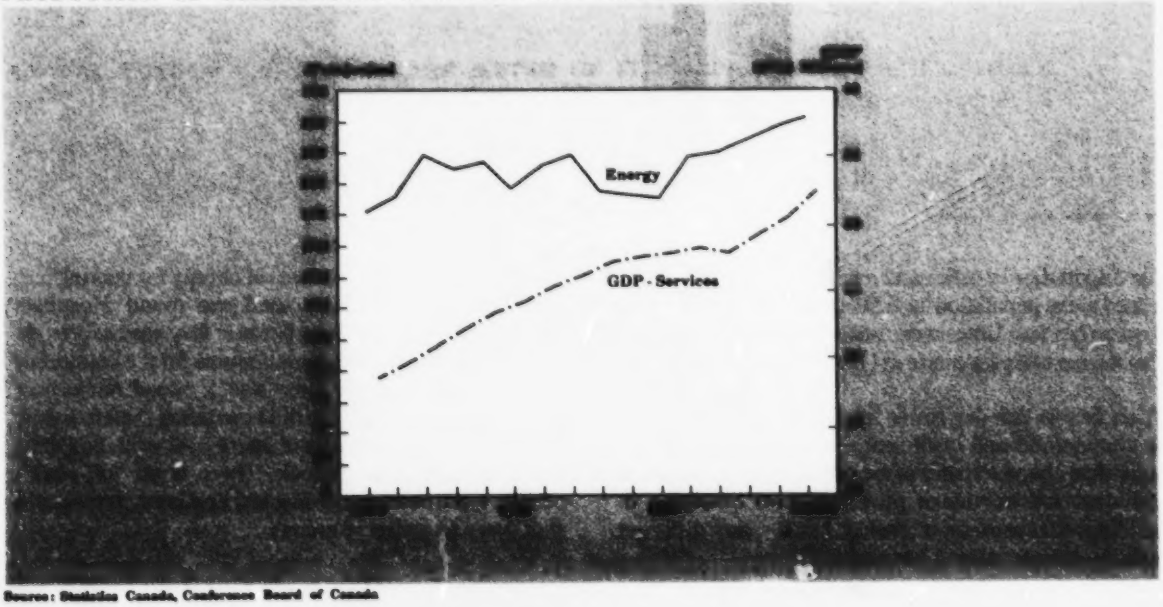
But there are significant variations in how energy is used among the various types of buildings. For example, schools, hospitals, and churches use more than the average percentage of their total energy consumption for space heating. Offices, stores and warehouses use less than the average for space heating, but more than the average for lighting. Energy used to run auxiliary equipment such as freezers, display cases and other equipment is most important in retail stores, accounting for one-third of the total energy used. Offices and warehouses are also heavy users of energy for auxiliary equipment.

The amount and kind of floorspace required by the commercial and institutional segment of the economy are largely determined by economic and population growth and the age composition of the population. As the population increases, more commercial and institutional buildings are required to satisfy increased demand for shopping, recreation and office space. A good example of the impact of the age composition of the population on the kind of floorspace needed is the effect of the baby boom on school construction. During the 1950s, 1960s and early 1970s, school construction increased rapidly to accommodate the boom. Now, schools are closing or being converted to other uses, as the school-age population declines. And, as this bulge in the population grows older, more space will be required in hospitals, nursing homes and homes for seniors.

Over the 1970-85 period, output and employment in the service industries increased rapidly. By 1985, Ontario's services output was more than 60 per cent higher than in 1970, and employment had expanded by over 70 per cent, or by 1.3 million jobs. These increases in output and employment stimulated a 70 per cent increase in commercial and institutional floorspace over the same period.

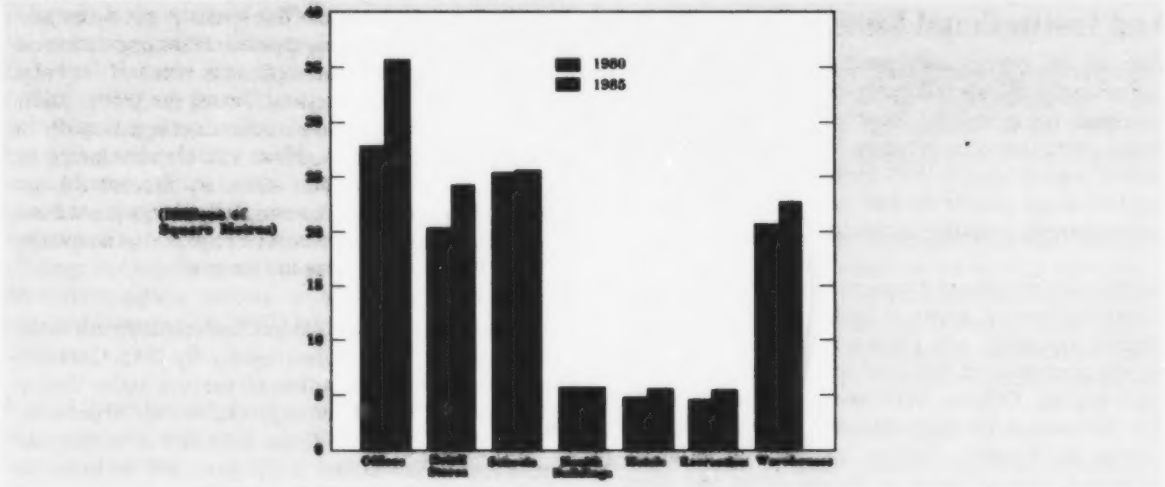
Since 1980, office floorspace has increased by nearly 30 per cent. Retail, hotel and recreational floorspace has increased by about 20 per cent, and warehouses by about 10 per cent over the same period. By contrast, there has been less than a one per cent growth rate in school floorspace, and no growth in health buildings.

PRODUCTION OF COMMERCIAL SERVICES AND ENERGY USE



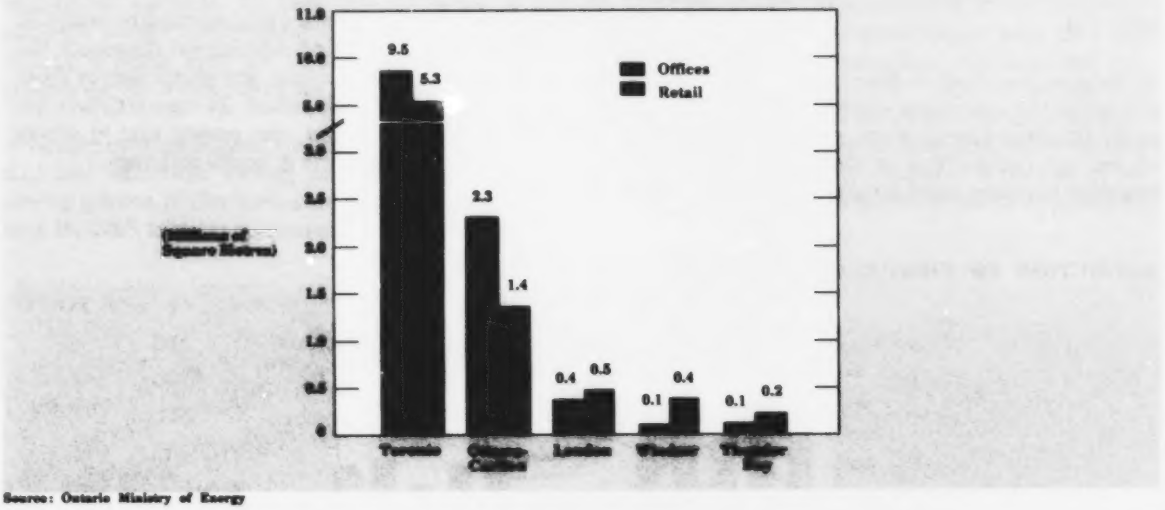
Source: Statistics Canada, Conference Board of Canada

FLOORSPACE BY BUILDING TYPE IN ONTARIO



Source: Ontario Ministry of Energy

OFFICE AND RETAIL FLOORSPACE IN SELECTED CITIES - 1983



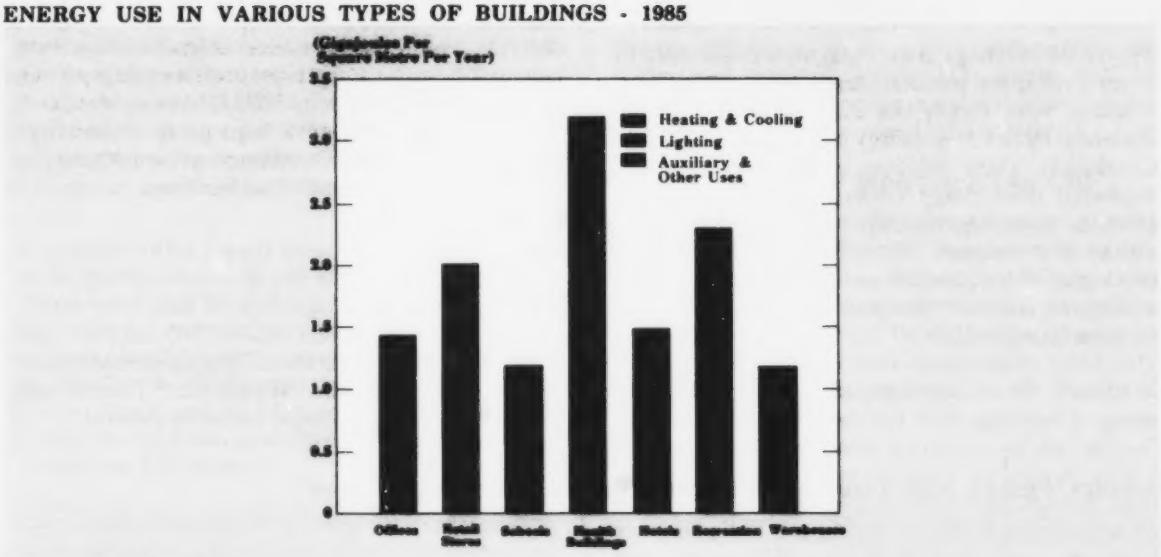
Source: Ontario Ministry of Energy

The distribution of office and retail floorspace is directly related to the population base being served. For example, Toronto has four times more office and retail floorspace than the next-largest centre in Ontario, Ottawa-Carleton.

Other factors that determine the amount of energy used by commercial and institutional buildings include the individual characteristics of the building and the types of activities and service it provides. Two examples of buildings that use a lot of energy, but for very different reasons, are arenas and hospitals.

Arenas require large amounts of energy for making ice, particularly if the arena is used year-round. Hospitals have high energy demands, because they need to provide higher-than-usual room temperatures for the comfort of patients, and because they use a broad variety of specialized equipment, such as operating theatre lights, that require large amounts of energy. As well, hospitals are in use around-the-clock. There is no "off-peak" period, when heating, cooling and lighting systems could shut down to conserve energy.

ENERGY USE IN VARIOUS TYPES OF BUILDINGS - 1985

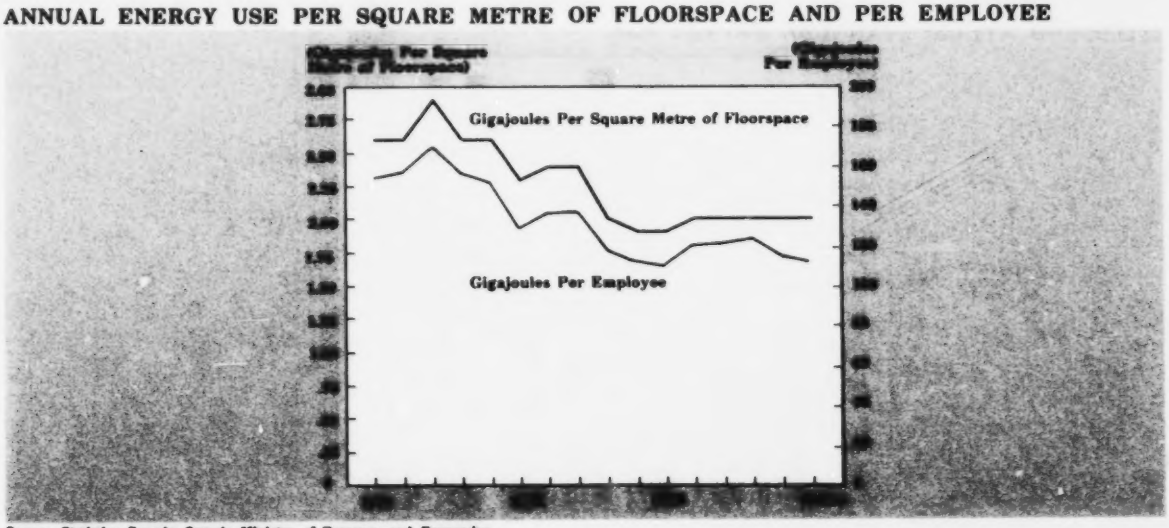


Source: Ontario Ministry of Energy

By contrast, warehouses and office buildings have much lower energy requirements than hospitals and arenas. Warehouses usually have minimal heating demands, and are generally occupied only during part of the day. Therefore, most energy-using systems can be shut down entirely for part of the day, or operated at reduced rates for at least some of the time. Office buildings can follow a similar pattern during the night and on weekends.

Energy use in Ontario did not keep pace with the growth in floorspace, output, or employment over the 1970-85 period. The total energy consumed increased by about one third. Compared to 1970, the amount of energy consumed per unit of floorspace and per employee in 1985 had declined by about 24 per cent. Clearly, commercial and institutional building owners, operators and users are now more energy-efficient than they were in the early 1970s.

ANNUAL ENERGY USE PER SQUARE METRE OF FLOORSPACE AND PER EMPLOYEE



Source: Statistics Canada, Ontario Ministry of Treasury and Economics

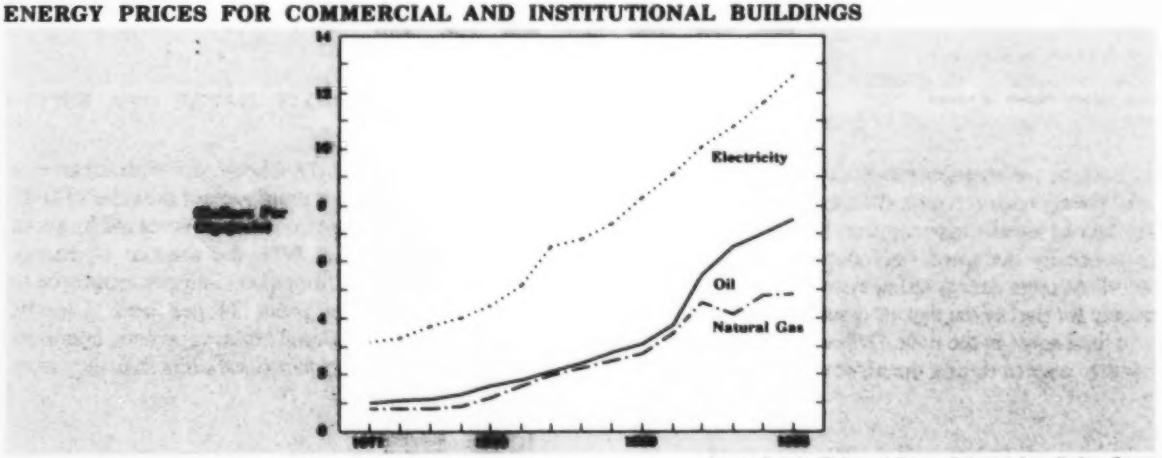
The Impact of Energy Conservation

Many of the buildings in use today were constructed in the era of cheap and plentiful energy prior to 1973. These structures were simply not designed to use energy efficiently. However, as energy costs escalated over the past decade, many building owners and operators discovered that energy conservation could reduce operating costs significantly, often without major additional investment. Simple measures, such as reducing inside temperatures and turning out lights when buildings are not in use, have had a substantial impact on many operating budgets.

On balance, the average energy efficiencies for a wide variety of buildings show that there has been a general improvement in almost all categories of buildings in Ontario. On a percentage basis, office buildings have improved the most – using 14 per cent less energy per unit of floorspace in 1985 than in 1980. Of course, changes in the average efficiency of a large group of buildings sometimes mask the outstanding progress achieved in a smaller grouping, or, individual buildings.

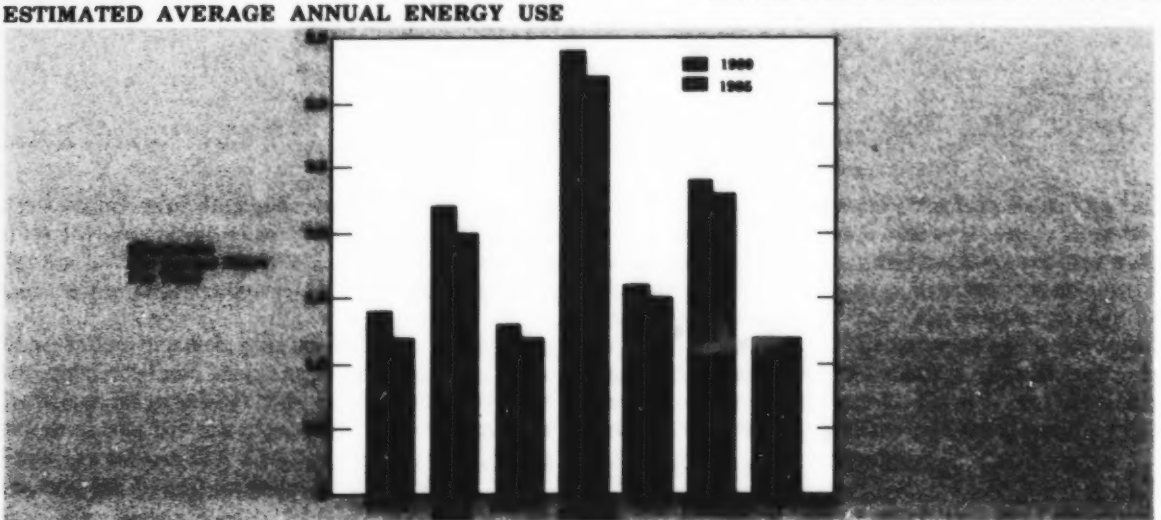
One group of five downtown Toronto office buildings is an excellent specific example of the savings that can be achieved. These buildings reduced their total energy consumption by 29 per cent between 1975 and 1983. Total energy use declined from about 2.8 gigajoules per square metre per year, to less than 2.0 gigajoules.* These savings were achieved without major capital investment.

ENERGY PRICES FOR COMMERCIAL AND INSTITUTIONAL BUILDINGS



Source: Ontario Ministry of Energy, Estimated from Various Sources

ESTIMATED AVERAGE ANNUAL ENERGY USE



Source: Ontario Ministry of Energy

*A gigajoule is one billion joules, or the energy in 29 litres of gasoline.

Another good example is the progress achieved by the government of Ontario in reducing the amount of energy used in publicly-owned buildings. Since 1980, energy consumption in nearly 3,000 government buildings has been reduced by a total of 30 per cent. These energy savings amounted to over $54 million by the end of 1984, and were achieved with a total expenditure of under $20 million.

Ontario's colleges and universities have also achieved outstanding savings on energy in recent years. In 1975-76, all secular post-secondary institutions used an average of 2.4 gigajoules of energy per square metre of floor space annually. By 1983-84, energy consumption had declined by over 20 per cent, to 1.9 gigajoules. In total dollar savings, this reduction in energy consumption amounted to more than $65 million.

New buildings have greater potential for energy savings, since new design features and construction techniques can be used to maximize energy efficiency. New commercial and institutional buildings can be designed to have energy use levels of between 0.5 and 1.0 gigajoules per square metre per year, compared to an average of 1.5 to 2.0 gigajoules for buildings in 1980.

Inevitably, as new buildings replace older ones, the energy efficiency of the entire commercial and institutional sector in Ontario will improve. But this process is slow, since buildings are among the longest-lived components of our social infrastructure.

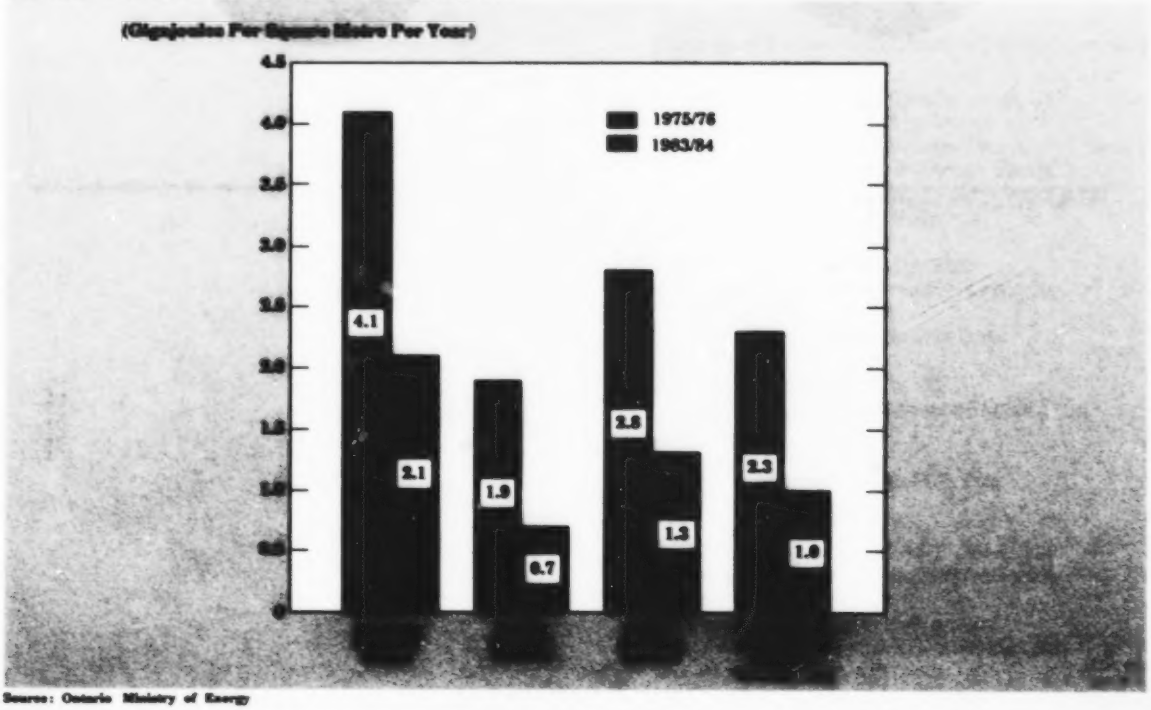
Decreasing Our Reliance On Oil

While Ontario's total energy consumption increased by one-third in the 1970-85 period, the amount of oil used declined by 60 per cent. In 1970, oil supplied more than 40 per cent of the total energy consumed in commercial and institutional buildings. By 1985, oil accounted for just 13 per cent of their total energy needs. Obviously, other fuels were substituting for oil.

Natural gas was the major beneficiary of the "off oil" movement, increasing its market share to 54 per cent of total energy use in 1985 from 32 per cent in 1970. Virtually all of this growth in natural gas use was for space-heating. The majority of today's new commercial and institutional buildings use natural gas as a space-heating fuel.

Although electricity also substituted for oil for space-heating in some buildings, the major reason for electrici-

IMPROVEMENTS IN ENERGY EFFICIENCY



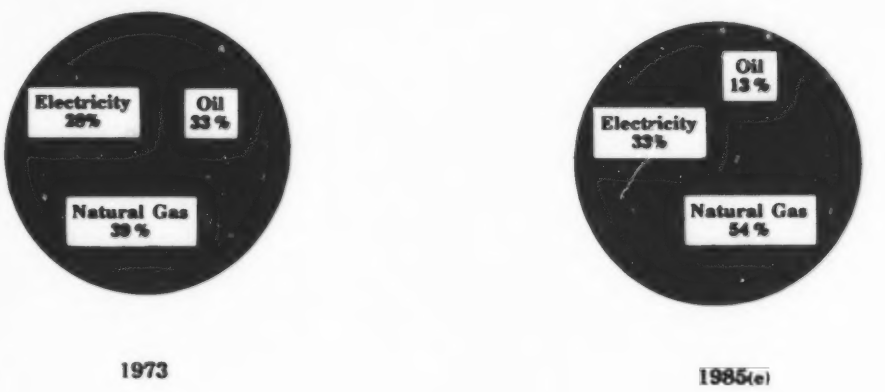
Source: Ontario Ministry of Energy

ty's more widespread use was an increase in the use of air-conditioning and other equipment. Increasingly, offices, hotels and wholesale and retail establishments are adding more electrically-powered equipment, such as computers, photocopiers and word-processing machines to enhance employee productivity. This trend began in the mid-1970s, and is still accelerating. By 1985, electricity's share of total energy use had increased by 11 percentage points, to 33 per cent from 22 per cent in 1970.

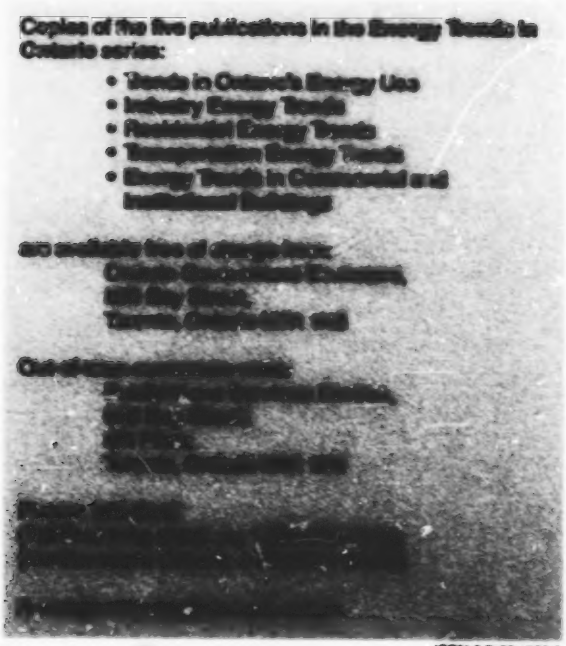
At present, energy sources such as wood, propane and solar, have very limited use in commercial and institutional applications in Ontario. However, over the last several years, institutions like Grenville Christian College near Brockville, Kingsway College in Oshawa, and Hillcrest High School in Thunder Bay, have installed wood-fired heating plants to replace either oil- or gas-fired facilities.

As well, some operations that require low-temperature hot water, such as swimming pools and car washes, have installed solar water heaters to replace conventionally-fuelled facilities. Although the amounts of energy and money saved are small, in comparison with the total energy used by the commercial and institutional sector, the popularity of alternative fuels is expected to increase in the future.

ENERGY USE IN COMMERCIAL AND INSTITUTIONAL BUILDINGS



Source: Ontario Ministry of Energy



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Ontario

Ministry of Energy

Honourable Vincent G. Kerrio Minister

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